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Considering emotions in product package design through combining conjoint analysis with psycho physiological measurements.

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Abstract

Successful new product development is a basis for economic growth and exporting ability. It is also a guarantee of survival for enterprises. As products have to be attractive for customers, the main role in new product development is on the customer-needs analysis. Conjoint analysis is one of the most used methods in mapping of consumer preferences. Nowadays consumers are mainly satisfying higher-order needs and therefore the role of emotions and thus visual design of product package in buying decisions has increased. Conjoint analysis in the same time presumes that consumers are rational in their decisions and are maximizing their utility functions. In this paper we combined conjoint analysis method with psycho physiological measurements. Usually in conjoint analysis respondents have to rank conception cards based on their preferences. We ranked pictures of product versions based on the measured strength of the positive emotions these pictures created to respondents. In the study we manipulated with the visual elements of apple juice carton and conducted an "emotion based conjoint analysis" with 107 persons. Results indicate that with the help of our combined method it is possible to detect how important are different visual factors on the package in generating positive emotions to buyers.

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Keywords: product packaging design; conjoint analysis, measurement of emotions, facial expressions.

1. Introduction

It is more and more difficult to choose between alternative products in stores and often emotions become stronger arguments than our rational reasons in buying situations. Designers can easily create eye catching package designs, but too outstanding and the product becomes uninviting. So the key is to find best combination

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of visual elements for generating positive emotions. Conjoint analysis is a well-known method for finding out best combinations, but rationally ranked results aren't always matching with consumer's emotional behavior in buying situation. Although measuring emotions in marketing is more and more popular, it is mostly for scientific reasons and practical psycho physiological measurements are rare due to high costs.

In this paper we are trying to test a new method in which facial emotions as input from web cameras is combined with conjoint analysis to find out whether our combined method enables to find out the importance of different package design elements in the creation of positive emotions to buyers. The structure of our paper is following: firstly we are defining emotion in marketing and introducing its role in consumer's buying behaviour; next we are discussing over rationality of conjoint analysis and its possibilities to measure emotions; next introducing different psychophysiological techniques in marketing research including facial EMG. After literature overview we explain used methodology and introduce results. Our paper ends with short discussion over putting our method into practice.

2. Literature overview

Despite the debates of defining emotions, there is a common opinion that emotion is a mental state of readiness that arises from relevant events or thoughts (Bagozzi, R. P., Gopinath, M. & Nyer, P. U. 1999) and are often expressed physically (e.g. in different gestures, facial expressions and body postures) (Chamberlain, L.& Broderick, A. J. 2007). Emotions arise if something relevant to a person is experienced and the emotional response is an evaluation or interpretation of that event (Bagozzi, R. P., Gopinath, M. & Nyer, P. U. 1999). Although different people can have different reactions (or no emotional reactions at all) to same events, Ekman found that emotional expressions are fairly similar with all people (Ekman, P. 1973).

Studies have shown that emotions strongly influence consumers buying behavior (Babin, B. J., Griffin, M.& Boles, J. S. 2004); (Bagozzi, R. P., Gopinath, M. & Nyer, P. U. 1999), especially in case of impulse buying (Donovan, R. J., Rossiter, J. R., Marcoolyn, G. & Nesdale, A. 1994), (Rook, D. W. & Gardner M. P. 1993), (Weinberg, P., Gotwald, W. 1982). The wide range of alternatives in grocery stores have led to situation the customer has to pick the most suitable product by choosing the best (most attractive, informative or high quality) package design (Wells, L. E., Farley, H., & Armstrong, G. A. 2007); (Marsh, K. & Bugusu, B. 2007), (Hoegg, J.& Alba, J. 2011). As Cahyorini and Rusfian (2011) have found out, the packaging strongly affects buying behavior, and packaging visual design plays the main role (Dobson, P. & Yadav, A. 2012) for making emotional buying decision. According to Butkeviciene et al (2008), both verbal (brand name, information, producer etc) and nonverbal (color, form, graphics etc) product's package components have impact on consumer emotions and therefore on buying decision (Loewenstein, G. & Lerner, J. S. 2003).

Not all methods are suitable for detecting consumers' preferences because consumers often are not able to articulate their needs and wishes (Millet, S. 2006); (Hauser, J. & Rao, V. 2003) or, as a result consider most factors identically "extremely important" (Gale, B.T. & Wood, R.C. 1994). Conjoint analysis, first introduced by Luce and Dukey (1964), allows defining customers' needs more accurately than is possible with using simple questionnaires (Anderson, J.C.; Jain, D.C. & Chintagunta, P. 1993). Rather than ask about the importance of attributes individually, the research setting is made quite close to actual decision making in a real market: where the customer's task is to rank the different product alternatives which are offered to him and pick out the one that creates most value for him (Kotri, A. 2006). According to Krieger et al (2004) conjoint analysis assumes that it is possible to describe a product or a service as an aggregate of its conceptual components – attributes and their levels (elements). By presenting a series of product concepts, which are combinations of few relevant attributes and limited number of elements, to a number of respondents and finding out which are most preferred concepts, conjoint analysis allows the statistical determination of utilities of each of the elements (individual utility scores of the elements) (Kessels, R., Goos, P. & Vandebroek, M. 2008). According to these utility scores it is possible to deduce which combination of product features is the most preferred. Usually it is assumed in conjoint analysis that customers follow the compensatory preference model (low score of a certain attribute can be compensated by a high score of another attribute) (Louviere, J. 1988); (Hauser, J.R., Ding, M. & Gaskin, S.P. 2009). In other

words, conjoint analysis assumes that consumer is rational in decision-making. Several studies reveal however that the decision model adopted by consumers depends on the context and very often relies on heuristic non-compensatory decision strategies *Hauser, J.R., Ding, M. & Gaskin, S.P. 2009); (Johnson, E. J., & Meyer, R. J. 1984). It is becoming clear in psychology that such intuitive decision-making strategies often rely on affective processes as well as result in detectable emotional shifts (Dane & Pratt, 2009). In summary, many economic decisions are made intuitively and whether conscious of automatic, appear frequently to be based on emotional rather than strictly rational cues (Ohme, R., Matukin, M. & Pacula-Lesniak, B. 2011). Therefore it is needed to combine conjoint method with methods, which measure emotions.

There is no sole best method to measure emotions. As Sherer (2005) has defined emotion as not only a mental state but as changes in the states of all or most of the organism subsystems (CNS-Central nervous system; NES - neuro-endocrine system; ANS – autonomic nervous system; SNS - somatic nervous system), he proposed that measuring emotions ideally needs to measure *the continuous changes in appraisal processes at all levels of central nervous system processing , the response patterns generated in the neuroendocrine, autonomic, and somatic nervous systems, the motivational changes produced by the appraisal results, the patterns of facial and vocal expression as well as body movements, and the nature of the subjectively experienced feeling state that reflects all of these component changes (*Scherer, K.R. 2005: 709). Poels and Dewitte (2006) have pointed out that there are two major types of methods to measure emotions: self report methods and autonomic psychophysiological methods. If first ones focus on measuring the subjectively and consciously experienced feeling of a person, the second ones concentrate on continuous emotional reactions that are not distorted by higher cognitive processes.

In the case of self-report methods respondents have to express somehow their subjective feelings. For that reason there are created several different verbal scales, for example PAD (Mehrabian A. & Russell J. A. 1974), EPI (Plutchik, R 1980), DES (Izard, C. E. 1977), GALC and GEW (Scherer, K.R. 2005); and also visual scales, for example SAM (Lang, P.J. 1980). These methods are cheap and easy to use but they have also weaknesses. Several authors (for example Ohme, R., Matukin, M. & Pacula-Lesniak, B. 2011, Poels, K. & Dewitte, S. 2006, (Davidson, R. J. 2004) have pointed out that emotions cannot be measured adequately by self report methods because despite that psychologists have tended to view emotions as intrinsically conscious, there exist also non-conscious affects (Berridge, K. C., & Winkielman, P. 2003) or emotions are too complex and respondents are not aware about how they exactly feel (Wiles, J. A. & T. B Cornwell 1990).

On the other hand psychophysiological methods measure changes in central, autonomic and somatic nervous systems. Wang and Minor (2010) have mapped a validity and reliability of several different psychophysiological techniques in marketing research. In conclusion they found that valid techniques for measuring pleasure or valence of the emotion are EEG (Differences of electrical activity in two brain hemispheres); Facial EMG (Electrical contraction of facial muscle fibres) and fMRI, PET, or MEG (Changes in chemical composition or changes in the flow of fluids in the brain). EEG (electroencephalography) enables to measure the asymmetries of electrical activity of brain hemispheres in frontal part of the human brain. It has been proposed that the greater activity of the left hemisphere is associated with approach-related action planning (and therefore related with positive emotions caused by stimuli), and the grater activity of the right hemisphere should be associated with withdrawal-related emotion (Davidson, R. J. 2004). In recent years EEG technologies have started to become increasingly affordable as well as portable making them viable contenders for the toolbox of marketing research (e.g. Ohme, R., Matukin, M. & Pacula-Lesniak, B. 2011; Jones, H. E., Gable, P. A. & Peterson, C. K. 2010; Hazlett, R.L., & Hazlett, S.Y. 1999; Bolls, P. D., Lang, A. & Potter R.F. 2001; Larsen, J. T., Norris, C.J. & Cacioppo, J.T. 2003). But EEG has also some weaknesses. As Ohme et al (2011) have claimed, asymmetry of brain activity is still a conceptual construct with obvious limitations and some competing explanations. Functional Magnetic Resonance Imaging (fMRI), Positron Emission Tomography (PET), and Magneto encephalography (MEG) enable to get more exact overview about the processes happening in brain (Wang, Y. J & Minor, M. S 2008) but there methods are very expensive.

In this paper the focus in on measurement of facial expressions. Cacioppo, with colleagues (1986) have stated that facial EMG is highly reliable measure of affective states given the fact that each basic emotion is

characterised by a unique, culturally universal and often involuntary facial expression. Ohme et al (2011) have stated that this method offers a powerful instrument to test voluntary (zygomaticus) and involuntary (corrugator and orbicularis) facial muscle movements, which may reflect the conscious and subconscious expression of emotions. If EMG uses only two facial muscles to measure emotions, Ekman and Friesen (1978) have proposed the Facial Actions Coding System (FACS) to identify basic emotions from facial expressions taking into account also other facial muscles. Teixeira, Wedel and Pietesrs (2012) claimed that manual coding is error-prone, laborious, and difficult at the high temporal resolutions and used therefore automated statistical detection of basic emotions from facial expressions.

3. Method and data

We decided to use juice carton package design for our study. Juice is bought relatively often and in the same time is not an article of prime necessity. Therefore emotions should play a more important role in decision making process than in buying bread or milk. We chose 7 elements to change (see Figure 1)

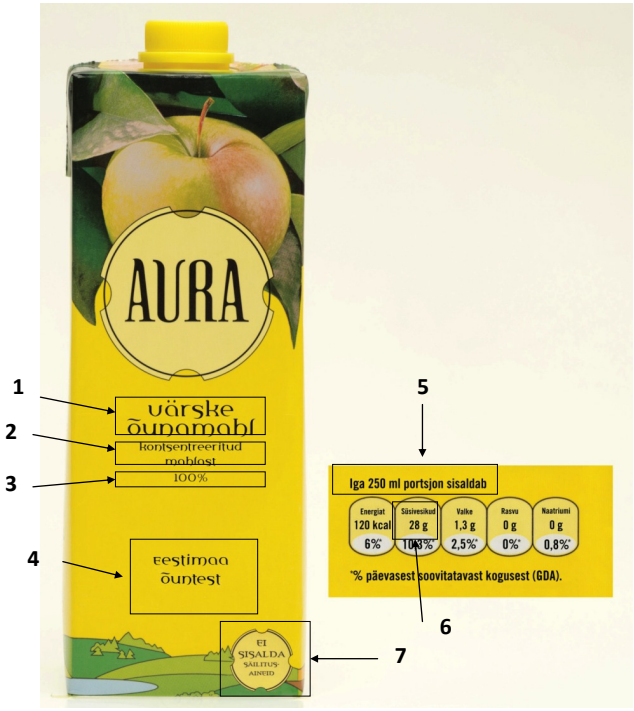

Fig. 1. Elements of the package design which were used in the study

First element was the name of the product. We created 3 versions of name:

- Apple Juice
- Fresh Apple Juice
- Pure Apple Juice

Second element was the label indicating that the product is made from concentrated juice. We had 2 versions:

- There was text: “made from concentrated apple juice”
- There was no text.

Third element was the font size of the percent of the juice in the product. We had 2 versions bigger and smaller font size. Next, we manipulated with the slogan. We had 3 versions:

- There was a slogan: “from Estonian apples”
- There was a slogan: “ a juice with good aura”
- There was no slogan.

Every juice package in Estonia has nutrition information how much energy or fat or sugar etc one portion contains. For fifth element we manipulated with the size of the portion. We had 2 versions:

- One portion is 200ml
- One portion is 250ml.

On the nutrition information label different producers present different features of the product. One such difference is showing sugar or carbohydrates. This was the sixth element we manipulated with. We had 3 versions. On the nutrition information was showed:

- One portion consists sugar 22.4g
- One portion consists carbohydrates 24g
- One portion consists sugar 0 g (is sugar free)

Finally the eighth element was a label presented in the lower corner of the front side. Usually there is presented info about the energy inside the product we created 3 versions:

- There was a label: “energy 120 kcal”.
- There was a label “does not contain preservatives”
- There was no label.

As a part of conjoint analysis we used orthogonal design and created 16+3 different combinations of the 7 elements. High quality pictures were taken in a photo studio, and these pictures were then modified with Photoshop software into the 19 designs given by the orthogonal design. These 19 pictures (cards) were uploaded to the special webpage provided by Realeyes Data Services Ltd (hereafter Realeyes) and presented in random order to 107 persons. Every card was showed 8 seconds, there was a one second gap between every card in order for the test subjects’ eyes to have time to rest.

Emotions were measured with the technology developed and provide by Realeyes. This technology bases on the FACS by plotting the position of facial features, such as eyebrows, mouth and nostrils, and employing algorithms to interpret changes in their alignment. The detecting and plotting is executed through the web camera. With this system Realeyes is able to detect 6 basic emotions as anger, disgust, fear, happiness, sadness and surprise. Additionally they have created 3 aggregated indicators: engagement, neutral and valence. [47] In our study we used only two indicators: happiness and engagement. First indicator is representing positive

emotions, the latter shows the existence of any measured emotions. All indicators are calculated on the scale 0%-100% showing, how big percentage of respondents had this particular emotion.

4. Results

Nineteen cards were showed to 107 persons. There are 2 conditions important to measure emotions through webcam: the technical quality of the webcam and the lighting. These two conditions were tested for every card over all respondents. Only results with good technical quality were taken into account (Table 1).

Table 1. Main results of the emotions testing

Card no	No of respondents	Happy	Engaged
Card3	61	19,70	42,60
Card6	58	17,20	36,20
Card14	60	18,30	35,00
Card1	66	15,20	36,40
Card9	63	12,70	38,10
Card7	63	19,00	31,70
Card13	65	16,90	33,80
Card12	60	16,70	33,30
Card15	62	11,30	37,10
Card4	62	9,70	33,90
Card11	58	13,80	29,30
Card5	59	10,20	32,20
Card17	61	8,20	31,10
Card19	61	13,10	26,20
Card16	63	11,10	27,00
Card18	61	9,80	26,20
Card2	63	12,70	22,20
Card8	57	8,80	24,60
Card10	63	6,30	25,40

Table 1 reveals that for every card we did get 57-66 high quality observations. Numbers in columns “Happy” and “Engaged” show the percentage of respondents whose faces expressed particular emotions during the time the specific card was showed.. Table 1 reveals that the ability of different package designs to create positive emotions and engagement was not equal: it differed in creation of happiness even more than three times (card no 10 with the happiness value 6.30 vs card no 3 with the happiness value 19.70 points). As shown in the Table 1 the results are aggregated over all observations. Conjoint analysis on the contrary demands that cards must be ordered by each respondent based on individual evaluations. We asked and did get additionally raw data from Realeyes in binary form indicating whether the respondent did or did not have a certain emotion during watching certain card. Based on that data it was also impossible to order cards for each respondent. Therefore, to conduct conjoint analysis we had to carry out two modifications:

- For evaluation of the cards we created new aggregated variable “Emotion” (sum of the values of “Happy” (1 or 0) and “Engaged” (1 or 0)). So, the value of this variable ranged from 0 if neither emotion were detected to 2 if both emotions were detected.

- We created "average persons" by selecting randomly 30 respondents and calculating their average value of variable "Emotion" for every card. Cards were then ordered by these average values. This procedure was repeated 40 times. As a result we did get a database of ordered cards ranked by 40 "average respondents".

Results of the conducted conjoint analysis are presented in Table 2. It reveals that based on Pearson's R and Kendall's tau the model explains the variation of the variable "Emotion" very well.

Table 2. Results of conjoint analysis

Design elements	% of importance
6. Sugar or carbohydrates on the nutrition info label	25.663
4. Slogans or no solgan	25.231
1. Name of the product	17.954
5. Size of the portion on the nutrition info label	10.513
3. Size of the juice percentage font	8.568
7.Energy or preservatives info label or no text	7.417
2. Made from concentrated apple juice or no text	4.565

	Value	Sig
Pearson's R	0.939	0.000
Kendall's tau	0.783	0.000

Most important elements generating happiness and engagement were the information about sugar or carbohydrates and the existence of slogan on the package. Nowadays people are informed that sugar is not good for health and therefore they are much happier when they do not find the word "sugar" on the package of the apple juice. The formulation of slogan is very important. One slogan – a juice with good aura" – increased the value of Emotion variable, at the same time the other slogan – from Estonian apples – decreased the value of Emotion variable. It is a bit unexpected result while usually people care about the country of origin. Most unimportant element was the existence of the text that the juice is made from concentrated juice.

5. Discussion

In this study we were aimed to test our proposed (emotional conjoint) method, whether it enables to find out the importance of different package design elements in the creation of positive emotions to buyers. We decided to use juice package for the manipulations because as the juice is not an article of prime necessity, also impulse buying could be possible and according to Donovan, R. J., Rossiter, J. R., Marcoolyn, G. & Nesdale, A. 1994, Rook, D. W. & Gardner M. P. 1993, Weinberg, P., Gotwald, W. 1982 the emotions should influence more strongly consumers' decisions in this product category.

As we were not able to change significant visual elements or colors on the juice package, we made only minor changes in design and manipulated with text elements on the package. Nevertheless, the results of our study indicated that also only verbal product's package components have an impact on consumer emotions as it was stated also in the study of Butkeviciene et al (2008). Already the standard report of Realeyes (Table 1) revealed that some designs generated happiness to more than three times more respondents than other designs. And of course it is possible to deduce which elements are more powerful in generating positive emotions by comparing the more successful and less successful cards. We combined the measurement of emotions with conjoint analysis and therefore our proposed method should allow the statistical determination of utilities in

emotion creation of each of the elements (Kessels, R., Goos, P. & Vandebroek, M. 2008). According to these utility scores it is possible to deduce which combination of design elements creates most positive emotions.

We believe that our proposed method has good perspective to be used by practitioners because conjoint method makes it exact and electronic measurement of facial expressions makes it faster and less labor consuming. It also does not demand laboratory conditions as facial EMG, EEG or other more sophisticated methods do. Nevertheless we are in the very beginning of the long way. It was the first attempt to combine these methods. There are several possibilities to improve the method and to take in other emotions. The absence of individual data, which makes the use of conjoint method difficult needs special attention.

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Appendix A. Design of the cards for the conjoint analysis

Card no.	1. Name of the product	2. Made from concentrated apple juice or no text	3. Size of the juice percentage font	4. Slogans or no solgan
1	Fresh Apple Juice	Made from concentrated apple juice	Bigger	“a juice with good aura”
2	Pure Apple Juice	no text	Bigger	“from Estonian apples”
3	Pure Apple Juice	no text	Smaller	“a juice with good aura”
4	Apple Juice	no text	Smaller	“from Estonian apples”
5	Apple Juice	Made from concentrated apple juice	Bigger	No slogan
6	Apple Juice	no text	Bigger	“a juice with good aura”
7	Fresh Apple Juice	no text	Smaller	“a juice with good aura”
8	Fresh Apple Juice	Made from concentrated apple juice	Smaller	“from Estonian apples”
9	Apple Juice	no text	Smaller	No slogan
10	Fresh Apple Juice	no text	Bigger	No slogan
11	Pure Apple Juice	Made from concentrated apple juice	Smaller	No slogan
12	Apple Juice	Made from concentrated apple juice	Bigger	“from Estonian apples”
13	Apple Juice	no text	Bigger	“a juice with good aura”
14	Apple Juice	Made from concentrated apple juice	Smaller	“a juice with good aura”
15	Pure Apple Juice	Made from concentrated apple juice	Bigger	“a juice with good aura”
16	Apple Juice	Made from concentrated apple juice	Smaller	“a juice with good aura”
17	Pure Apple Juice	no text	Smaller	“a juice with good aura”
18	Fresh Apple Juice	Made from concentrated apple juice	Bigger	“a juice with good aura”
19	Pure Apple Juice	no text	Smaller	No slogan

Appendix A continues…

Card no.	5. Size of the portion on the nutrition info label	6. Sugar or carbohydrates on the nutrition info label	7.Energy or preservatives info label or no text	Status
1	250	Sugar	energy 120 kcal	Design
2	200	Sugar	does not contain preservatives	Design
3	200	Carbohydrates	energy 120 kcal	Design
4	250	Sugar	energy 120 kcal	Design
5	200	Carbohydrates	does not contain preservatives	Design
6	250	Carbohydrates	energy 120 kcal	Design
7	200	Sugar free	does not contain preservatives	Design
8	250	Carbohydrates	does not contain preservatives	Design
9	250	Sugar	does not contain preservatives	Design
10	200	Sugar	energy 120 kcal	Design
11	250	Sugar free	energy 120 kcal	Design
12	200	Sugar free	energy 120 kcal	Design
13	250	Sugar free	does not contain preservatives	Design
14	200	Sugar	does not contain preservatives	Design
15	250	Sugar	does not contain preservatives	Design
16	200	Sugar	energy 120 kcal	Design
17	250	Carbohydrates	energy 120 kcal	Holdout
18	250	Sugar free	energy 120 kcal	Holdout
19	200	Sugar	does not contain preservatives	Holdout